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コーヒー中のヒドロキシヒドロキノン (HHQ)
からの過酸化水素産生と制御

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Production and its inhibition of hydrogen peroxide
from hydroxyhydroquinone (HHQ) in coffee
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【目的】コーヒー中の DNA 鎖切断成分として、hydroxyhydroquinone (HHQ) を同定し、その切断作用は、酸素存在下中性で活性酸素種を発生するためであることを報告した。今回、コーヒーに含まれるポリフェノール類の中性における過酸化水素発生能を比較検討し、その発生の制御について検討した。

【実験】酸素電極を用い、中性溶液での溶存酸素濃度の消費とカタラーゼ添加による過酸化水素産生を検討したところ、HHQ の溶存酸素の消費量と過酸化水素の産生量は pyrogallol, hydroquinone, chlorogenic acid よりはるかに多いことが分かった。蛍光法による過酸化水素の定量を行った結果も同様であった。HHQ は 0.5-0.6 当量の過酸化水素を発生した。HHQ 溶液にはセミキノンラジカル、OH ラジカル、キノンの生成も認められた。HHQ による溶存酸素の消費、過酸化水素の産生、HHQ の分解、セミキノンラジカル、OH ラジカル、キノンの生成は、Cu, Zn-, Mn-, Fe-SOD により効率よく抑制されたことから、過酸化水素の産生に先行してスーパーオキシドが産生し、HHQ の自動酸化にスーパーオキシドが触媒的に作用していることが分かった。

【結論】コーヒー中の HHQ は効率のよい過酸化水素発生源であり、SOD は HHQ からの過酸化水素産生を効果的に抑制することが分かった。

**Production and its inhibition of hydrogen peroxide from
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[Object] We have already identified hydroxyhydroquinone (HHQ) as a DNA chain cleavage ingredient in coffee and reported that the cleavage effect is due to generation of active oxygen species under a neutral condition in the presence of oxygen. Here, we have compared the ability of polyphenols contained in coffee to generate hydrogen peroxide under a neutral condition and studied inhibition of its generation.

[Experiment] Using an oxygen electrode, we studied consumption of the dissolved oxygen concentration in a neutral solution and generation of hydrogen peroxide by addition of catalase, and found that the amount of the dissolved oxygen consumed by HHQ and the amount of the hydrogen peroxide generated by HHQ were far more than those of pyrogallol, hydroquinone and chlorogenic acid. The same result was obtained by quantification of hydrogen peroxide using fluorometry. HHQ generated 0.5 to 0.6 equivalent amount of hydrogen peroxide. Generation of semiquinone radical, generation of OH radical and generation of quinone were also observed in the HHQ solution. Since consumption of dissolved oxygen by HHQ, generation of hydrogen peroxide, degradation of HHQ, generation of semiquinone radical and generation of quinone were effectively inhibited by Cu, Zn-, Mn- and Fe-SOD,

it was found that superoxide is generated prior to generation of hydrogen peroxide and the superoxide catalytically affects self-oxidation of HHQ.

[Conclusion] It was found that HHQ in coffee is an effective source of hydrogen peroxide and SOD effectively inhibits generation of hydrogen peroxide from HHQ.